

SPECIES OF *DISCOCELIS* (PLATYHELMINTHES: POLYCLADIDA) FROM QUEENSLAND, WITH DESCRIPTION OF A NEW SPECIES

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Two species of *Discocelis* are described from intertidal waters from northern Queensland. The first species is characterised by the marginal eyes extending to the posterior region of the body, the presence of a seminal vesicle, cerebral eyes distributed more or less in anterior and posterior groups and a male antrum with complex lobes in dorso-ventral views. This species differs clearly from all congeners and is named *D. parvimaculata* sp. nov. The second has marginal eyes extending to the level of the cerebral organ, cerebral eyes arranged more or less in two groups, lacks a seminal vesicle and has prostatoids in the wall of the male antrum as well as in the penis papilla itself. The species is closely related to *D. pusilla* Kato, 1938. It is probably distinct but is not named owing to the poor description of *D. pusilla*. The records presented suggest that several species of *Discocelis* are present in Australian coastal waters and that the distribution of prostatoids seen in dorso-ventral views of the male antrum provides useful characters for distinguishing species within the genus. □ *Polycladida*, *Discocelis*, new species, taxonomy.

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The polyclad family Discocelidae Laidlaw, 1903 is a cosmopolitan family of essentially intertidal polyclads characterised by the presence of marginal eyes and small secretory organs, termed prostatoids, associated with the male reproductive system (Faubel, 1983). The family is currently represented by a single Australian species, *Discocelis australis* Hyman, 1959, found under rocks in the intertidal region close to Sydney (Hyman, 1959) and from West I., South Australia (Prudhoe, 1982). Faubel (1983) transferred *D. australis* to the related genus *Thalamoplana* Laidlaw, 1904, distinguished from *Discocelis* Ehrenberg, 1836 by possessing separate male and female gonopores. By contrast, Prudhoe (1985) considered that *Thalamoplana* warranted only sub-generic rank.

The presence of only a single Australian representative of the family is probably the result of lack of collecting rather than the family being poorly represented in Australian intertidal waters. This paper reports the presence of two additional species of *Discocelis* from Townsville, Queensland, one of which is clearly a new species.

METHODS

Polyclads were collected at low-tide from under rocks on exposed mud-flats. Fixation followed the technique of Newman & Cannon (1995) in which polyclads were placed on filter paper in a dish of sea-water and when fully

extended, the filter paper was rapidly placed on a block of frozen fixative, either 4% formaldehyde in sea-water or formaldehyde-calcium acetate-propylene glycol-propylene phenoxetol. Following fixation, worms were dehydrated in a graded series of ethanols, cleared in methyl salicylate and mounted in Canada balsam. The median posterior sections of individual polyclads were removed using a scalpel blade, embedded in paraffin and serial longitudinal sections, cut at a thickness of 7 µm, were stained with Gill's haematoxylin and eosin. Drawings were made using a drawing tube attached to an Olympus BH microscope. Measurements are presented in millimetres as the range followed by the mean in parentheses.

All specimens collected have been deposited in the Queensland Museum (QM).

Type specimens of *D. australis* from New South Wales (Australian Museum W3685) were compared with the new material.

POLYCLADIDA Lang, 1884

ACOTYLEA Lang, 1884

DISCOCELIDAE Laidlaw, 1903

Discocelis parvimaculata sp. nov.
(Figs 1-6)

MATERIAL. HOLOTYPE: Rowe's Bay, Townsville, Qld (19°16'S, 146°49'E), 17.vi.1997, coll. I. Beveridge, whole mount, unstained (QM G217321); 2 colour slides.



FIG. 1. *Discocelis parvimaculata* sp. nov., entire polyclad, dorsal view, showing pattern of pigmented maculae and extent of marginal eyes (ME arrows). Scale bar = 1mm.

PARATYPES: 5 entire specimens and fragments of 1 specimen, whole mounts; 1 set of sections stained with haematoxylin and eosin, Rowe's Bay, Townsville, Qld, coll. I. Beveridge, 1.vii.1994, 29.vi.1995 (QM G217322-7, serial sections G217328).

DESCRIPTION. Large, oval polyclads; holotype non-gravid specimen 13 long, 10 wide; gravid specimens, 18-21(19) long, 7-12(10) wide; dorsal surface fawn, darker in centre, covered with numerous small brown circular areas of pigment, larger brown patches in central regions, becoming smaller towards periphery (Fig.1); ventral surface pale grey; nuchal tentacles absent; cerebral organ 0.41×0.55 in holotype, $0.39-0.48$ (0.43) $\times 0.46-0.56$ (0.51) in paratypes, 2.58 from anterior extremity in holotype, 2.94-4.60(3.77) in paratypes; marginal eyes 3-4 deep, extend to posterior quarter of body, number of rows of

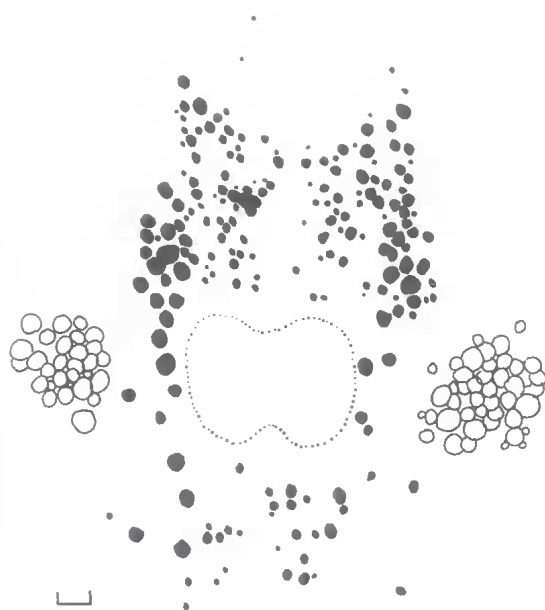


FIG. 2. *Discocelis parvimaculata* sp. nov., cerebral organ, tentacular and cerebral eyes showing variation between individual specimens (see Fig. 3). Scale bar = 0.1mm.

ocelli diminishes posteriorly; in most specimens, including holotype, eyes reach level of gonopore; in some specimens, eyes encircle body; cerebral eyes arranged in elongate groups, on either side of mid-line, 41-65 ocelli anterior to cerebral organ, 5-20 posterior to cerebral organ, anterior and posterior groups usually but not invariably separated (Figs 2,3); tentacular eyes with 25-40 ocelli per cluster; ruffled pharynx in mid-body, with 10-12 lateral folds, 11 in holotype; mouth at posterior end of pharynx, 4.9 from posterior end in holotype, 7.0-8.1(7.6) in paratypes; single gonopore 3.13 from posterior end in holotype, 5.5-6.8(6.0) in paratypes; antrum masculinum voluminous, folded in both dorso-ventral views and sagittal sections; in ventral views (Figs 4,5), antrum with prominent anterior lobe containing penis papilla and two lateral lobes each partially subdivided; in sagittal section (Fig. 6), several muscular lobes descend from dorsal surface of antrum; antrum with numerous pyriform prostates opening into lumen; in ventral view, prostates arranged in subcircular cluster on penis papilla and on posterolateral margins; in sagittal sections, prostates present on all pendant processes; no prostates present in wall of antrum; prostates of two histological types; most with faintly eosinophilic content; prostates

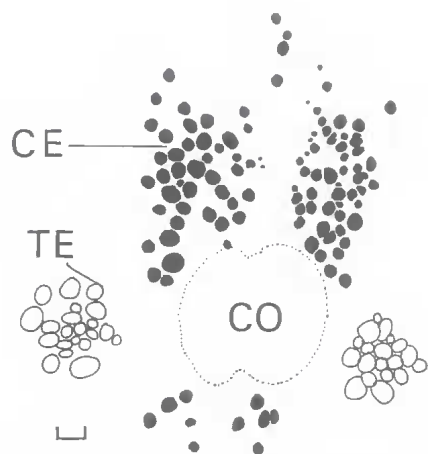


FIG. 3. *Discocelis parvimaculata* sp. nov., cerebral organ, tentacular and cerebral eyes showing variation between individual specimens. CE = cerebral eyes; CO = cerebral organ; TE = tentacular eyes. Scale bar = 0.1mm.

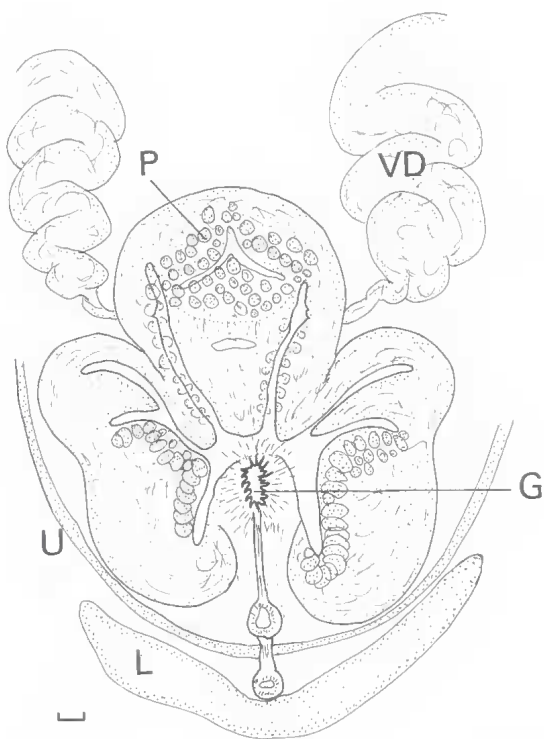


FIG. 4. *Discocelis parvimaculata* sp. nov., gonopore and genital complex, ventral view. G = gonopore; L = Lang's vesicle; P = prostatoids; U = uterine duct; VD = vas deferens. Scale bar = 0.1mm.

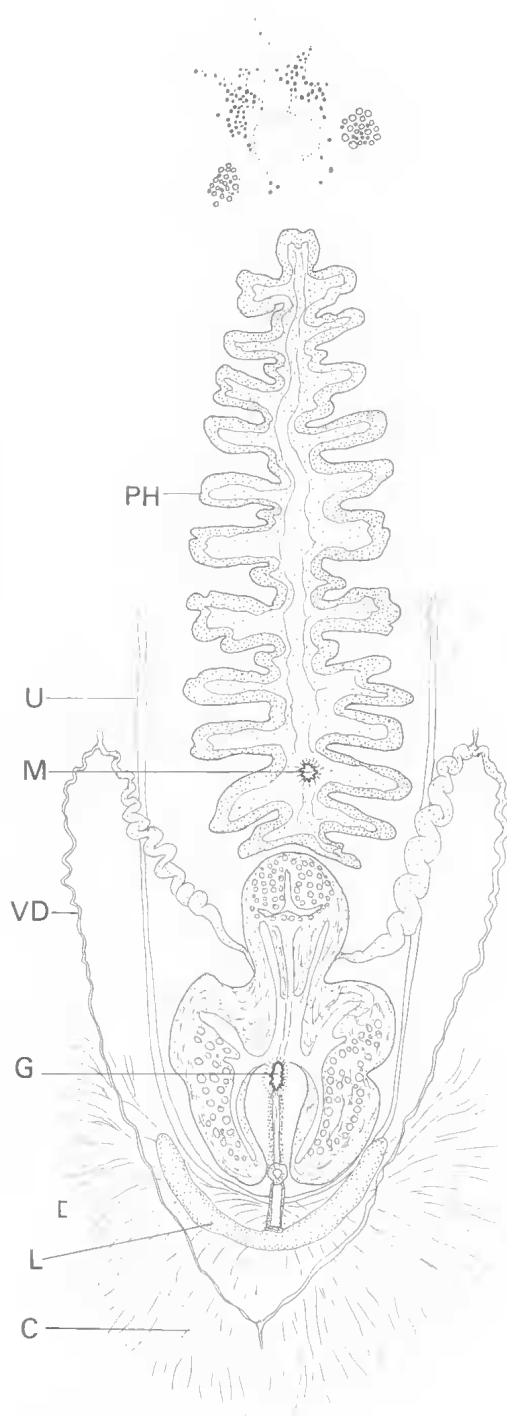


FIG. 5. *Discocelis parvimaculata* sp. nov., ventral aspect showing cerebral organ, eyes, pharynx and genital complex. C = cement glands; G = gonopore; L = Lang's vesicle; M = mouth; PH = pharynx; U = uterine duct; VD = vas deferens. Scale bar = 0.1mm.

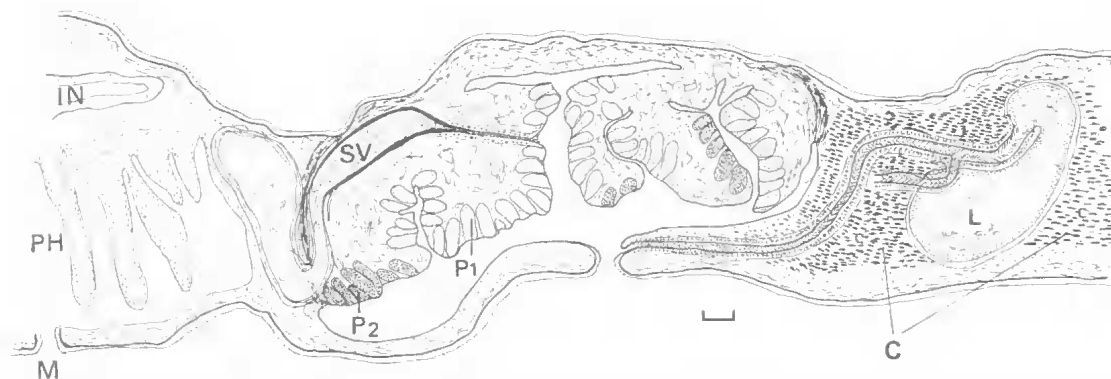


FIG. 6. *Discocelis parvimaculata* sp. nov., median sagittal section showing mouth, gonopore and histological details of genital ducts. C = cement glands; IN = intestine; L = Lang's vesicle; M = mouth; P1 = eosinophilic prostatoids; P2 = basophilic prostatoids; PH = pharynx; SV = seminal vesicle. Scale bar = 0.1mm.

at anterior extremity of antrum and on ventral or anterior surfaces of pendant processes of penis papilla with basophilic content; penis papilla fleshy, prominent, in anterior part of antrum; ejaculatory duct simple, straight; prostate absent; ejaculatory duct leads to pyriform seminal vesicle with thin but highly eosinophilic wall, passes ventrally, divides; walls of spermiducal bulbs highly muscular; vasa deferentia thin-walled, pass anterolaterally from male complex, to level of mouth, then divide; posterior branches coil posteromedially, uniting posterior to Lang's vesicle. No separate female gonopore; vagina opens into male antrum immediately posterior to common gonopore; vagina with thick muscular walls, ciliated lining, curves anteriorly to short, horizontal region; uterine canals empty into vagina immediately anterior to termination of vagina into prominently Y-shaped Lang's vesicle; uterine canals extend anteriorly on either side of pharynx; cement glands prominent in horizontal region of vagina, extend posteriorly and laterally into parenchyma, branched distally.

***Discocelis* sp.**
(Figs 7-12)

MATERIAL. Two specimens, Rowe's Bay, Townsville, Qld, 1.vii. 1994, coll. I. Beveridge, whole mount and serial sections stained with haematoxylin and eosin (QM G217329-30, serial sections G217331).

DESCRIPTION. Oval polyclads; gravid specimens 12-16 long, 5-8 wide; dorsal surface fawn, darker in centre, covered with numerous brown circular areas of pigment, larger patches in central regions, becoming smaller towards periphery (Fig. 7); ventral surface pale grey; nuchal tentacles absent; cerebral organ 0.33-0.45 ×

0.42-0.44, 2.5-4.6 from anterior extremity; marginal eyes in rows 3-4 deep, extend around anterior quarter of body, reach level of cerebral organ; cerebral eyes arranged in elongate groups, either side of mid-line, 31-42 ocelli anterior to cerebral organ, more or less separate from 4-7 posterior to cerebral organ (Figs 8,9); tentacular eyes with 18-30 ocelli per eluster; ruffled pharynx in mid-body, with 10 lateral folds; mouth at posterior end of pharynx, 5.2 from posterior end; single gonopore 3.4 from posterior end; antrum masculinum voluminous; prominent anterior penis papilla, circular in ventral view (Figs 10,11), with numerous prostatoids; wall of antrum encircling penis papilla bearing single row of prostatoids; antrum with 2 laterally directed branches on each side, immediately anterior to gonopore; anterior pair of lateral branches with row of prostatoids along posterior margin; in sagittal section (Fig. 12), large muscular penis papilla descends from dorsal surface of antrum, with numerous pyriform prostatoids; prostatoids present in wall of antrum, restricted to anterior ventral region; prostatoids with faintly eosinophilic content; ejaculatory duct simple, straight; prostate absent; seminal vesicle absent; ejaculatory duct divides into vasa deferentia which pass anterolaterally from male complex, to level of pharynx, then re-divide; posterior branches coil posteromedially, uniting posterior to Lang's vesicle. No separate female gonopore; vagina opens into male antrum immediately posterior to common gonopore; antrum anterior to vaginal opening, prominent, muscular with thicker epithelium; vagina with thick muscular walls, ciliated lining, curves anteriorly; uterine canals empty into vagina anterior to prominent dorsal loop; vagina passes ventrally to enter

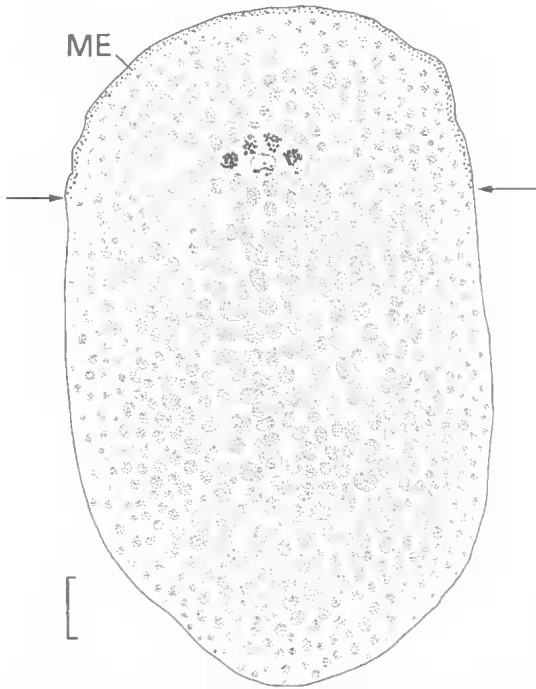


FIG. 7. *Discocelis* sp., entire polyclad, dorsal view, showing pattern of pigmented maculae and extent of marginal eyes (ME arrows). Scale bar = 1mm.

Y-shaped Lang's vesicle; uterine canals extend anteriorly on either side of pharynx; cement glands prominent, extend posteriorly and laterally into parenchyma.

DISCUSSION

Both species described above belong to the family Discocelidae since they possess marginal eyes and prostatooids opening into the male antrum (Faubel, 1983; Prudhoe, 1985). Generic distinctions within the family are not well defined, and although both Faubel (1983) and Prudhoe (1985) accept the validity of *Discocelis*, *Adenoplana* Stummer-Traunfels, 1933 and *Coronadena* Hyman, 1940, their definitions of these genera differ. In addition, *Thalamoplana* Laidlaw, 1904, accepted by Marcus & Marcus (1966), de Beauchamp (1961) and Faubel (1983), was not accepted as a valid genus by Prudhoe (1985). Both species described here differ from *Coronadena* in lacking the 7-11 large prostatic organs arranged radially around the male antrum in addition to the more numerous small prostatooids. *Adenoplana* was characterised by Stummer-Traunfels (1933) as having an interpolated prostatic organ. Faubel (1983) by contrast interpreted the prostatic organ of

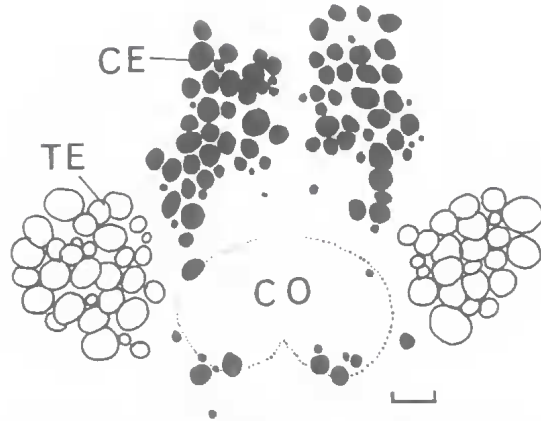


FIG. 8. *Discocelis* sp., cerebral organ, tentacular and cerebral eyes showing variation between individual specimens (see Fig. 9). CE = cerebral eyes; CO = cerebral organ; TE = tentacular eyes. Scale bar = 0.1mm.

Adenoplana as an ejaculatory duct lined with a glandular epithelium. Whatever the precise definition of the structures involved may be, *Adenoplana* differs from the species described here in possessing distinctly separate gonopores.

The remaining genera, *Discocelis* and *Thalamoplana*, are distinguishable on the basis of gonopores, with the former possessing a single gonopore and two gonopores in the latter. However, *D. australis*, which Faubel (1983) assigned to *Thalamoplana*, possesses a single gonopore, a feature which was confirmed by examination of the type specimens, while *D. insularis* Hyman, 1955 has the male and female systems opening at essentially the same point, which as Prudhoe (1985) has observed, is intermediate between the condition present in the type species of the two genera. For the present, Faubel's (1983) separation of *Discocelis* from *Thalamoplana* is accepted but *australis* is considered, following Prudhoe (1985), to be a

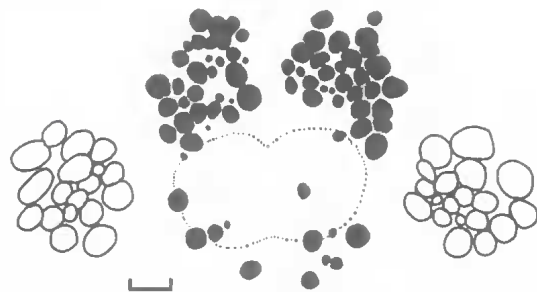


FIG. 9. *Discocelis* sp., cerebral organ, tentacular and cerebral eyes showing variation between individual specimens. Scale bar = 0.1mm.

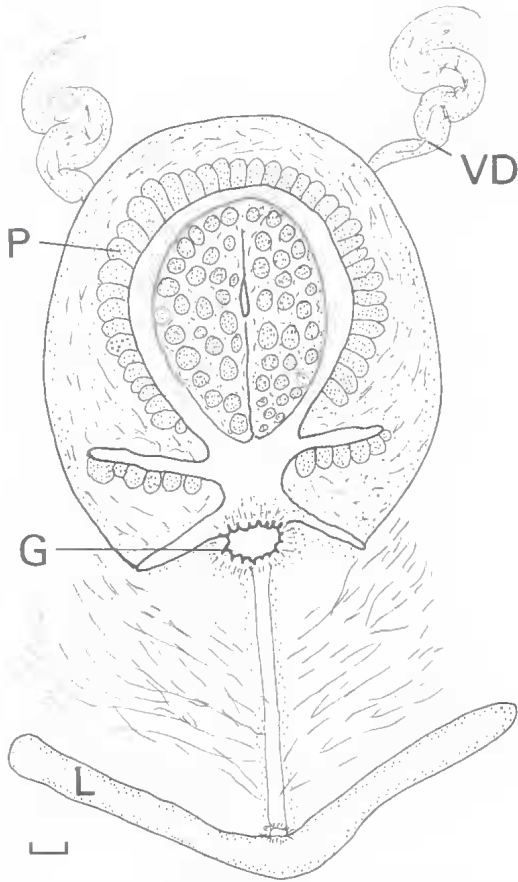


FIG. 10. *Discocelis* sp. gonopore and genital complex, ventral view. G = gonopore; L = Lang's vesicle; P = prostatoids; VD = vas deferens. Scale bar = 0.1 mm.

member of *Discocelis*. Both species described above are therefore assigned to *Discocelis* which consists of *D. australis*, *D. tigrina* (Blanchard, 1847), *D. fulva* Kato, 1944, *D. japonica* Yeri & Kaburaki, 1918 and *D. pusilla* Kato, 1938. The type species, *D. lichenoides* (Mertens, 1832), is considered unrecognisable (Hyman, 1959; Faubel, 1983; Prudhoe, 1985) and was treated as a species inquirenda by Faubel (1983).

Within *Discocelis*, the first species described above is immediately distinguishable from all congeners on the basis of the extent of the eyes, which in other species extend only as far as the region of the cerebral organ but in this species extend to, or almost to, the posterior end of the body. The marginal eyes also extend to the posterior part of the body in *Adenoplana* and *Coronadena*. The species described here differs from all congeners except *D. australis* in

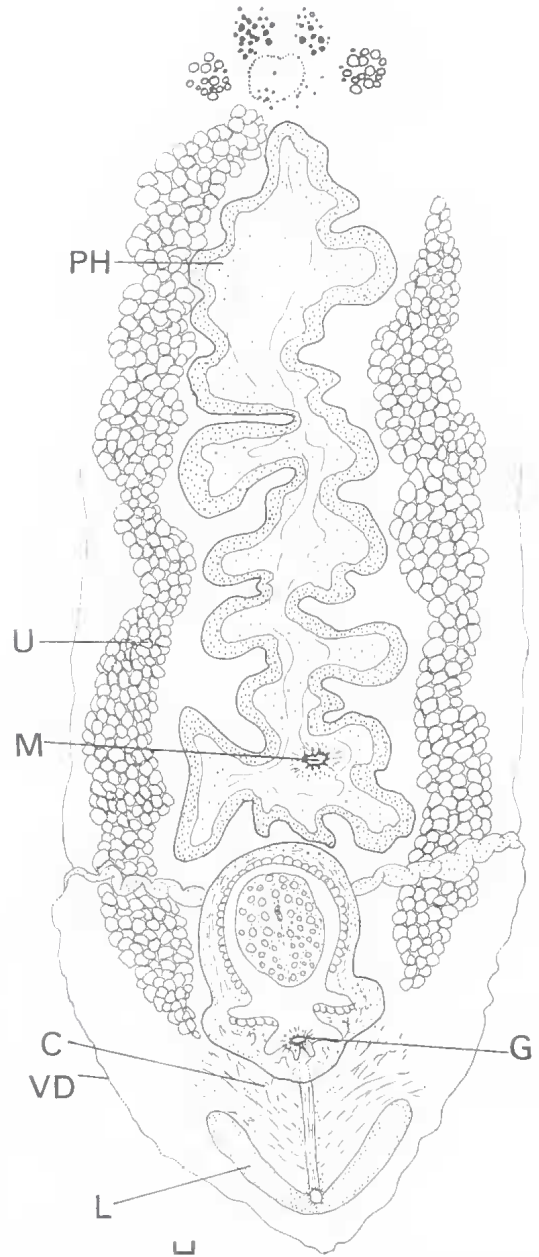


FIG. 11. *Discocelis* sp., ventral aspect showing cerebral organ, eyes, pharynx and genital complex. C = cement glands; G = gonopore; L = Lang's vesicle; M = mouth; PH = pharynx; U = uterine duct; VD = vas deferens. Scale bar = 0.1 mm.

possessing a seminal vesicle, though this was described as a muscular organ in *D. australis* by Hyman (1959) but has a thin, highly eosinophilic wall in the specimens described above. The specimens described here differ from *D. tigrina*

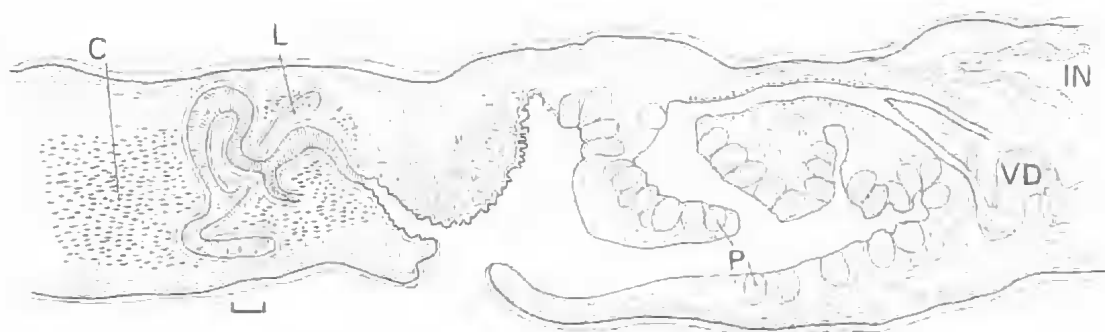


FIG. 12. *Discocelis* sp., median sagittal section showing mouth, gonopore and histological details of genital ducts. C = cement glands; IN = intestine; L = Lang's vesicle; P = prostatoids; VD = vas deferens. Scale bar = 0.1mm.

and *D. australis* in having a male antrum which forms five distinct lobes in dorsoventral views. In both of the other species the antrum is rounded, based on plate 13, fig. 1 of Lang (1884) for *D. tigrina* and observations of the type specimens in the case of *D. australis*. The morphology of the male antrum in dorsoventral view has not been described for the remaining species. The separation of the cerebral eyes into two clusters separates the species described here from *D. tigrina*, *D. australis* and *D. fulva* and the colour pattern of the dorsal surface, with numerous brown circular areas separates the species from *D. fulva* which lacks a distinctive pattern (Kato, 1944). The two types of prostatoids, one with eosinophilic content and the other with basophilic content may also distinguish this species from all congeners, although Kato (1944, fig. 2) illustrated two types of prostatoids in *D. fulva*, but did not describe the differences shown in the illustration. The morphological differences noted therefore indicate that the described specimens represent a new species for which the name *D. parvimaculata* is proposed based on the small size of the dorsal maculae compared with other

species in which the patterns on the dorsal surface have been adequately described.

The second species described above is distinguishable from *D. australis* and *D. parvimaculata* in lacking a seminal vesicle and from the latter species in having the marginal eyes restricted to the anterior region of the body. It differs from *D. tigrina* in having the mouth at the posterior end of the pharynx rather than in the middle and in having the cerebral eyes divided into anterior and posterior groups. In addition, the arrangement of the prostatoids in ventral view (Fig. 10) differs from that found in *D. tigrina* in which they are arranged in a U-shaped cluster around the anterior half of the penis papilla, with two lateral rows extending posteriorly (Lang, 1884, pl. 13, fig. 1).

The species is therefore most closely related to *D. fulva*, *D. japonica* and *D. pusilla*, all from Japan. The specimens are distinguishable from *D. fulva* since this species has no dorsal colour pattern, has numerous cerebral eyes arranged in a

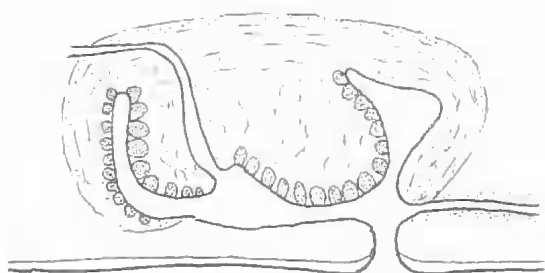


FIG. 13. Schematic representation of genital atrium of *Discocelis tigrina*, redrawn from Lang (1884).

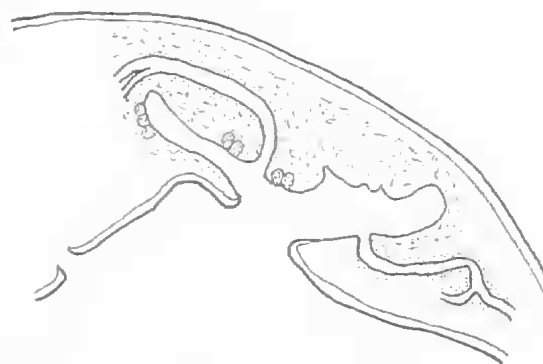


FIG. 14. Schematic representation of genital atrium of *Discocelis pusilla*, redrawn from Kato (1938).

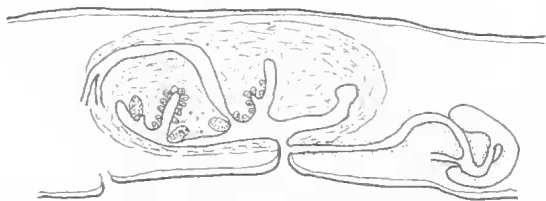


FIG. 15. Schematic representation of genital atrium of *Discocelis fulva*, redrawn from Kato (1944).

single elongate group and, according to the illustrations of the species, has prostates of two distinct sizes (Kato, 1944, fig. 2) (Fig. 15).

D. japonica differs in having 15-16 eyes in each posterior cerebral cluster rather than the 4-7 in the present specimens, and differs in the anatomy of the antrum masculinum and distribution of prostates (Fig. 16). In *D. japonica*, there are a number of projections into the antrum apart from the penis papilla, while in the current specimens only the penis papilla projects into the antrum. In addition, in *D. japonica*, a particularly elongate projection, lying dorsal to the vagina bears numerous prostates on both surfaces (Kato, 1937, fig. 2), while in the present specimens, the region of the antrum anterior to the vaginal opening is devoid of projections and prostates. Unfortunately, no ventral views of the antrum of *D. japonica* have been published. Finally, there are prostates in the ventral wall of the antrum in the current species and these are lacking in *D. japonica*.

The species described here is most similar to *D. pusilla* in colour pattern, having eyes restricted to the anterior part of the body, mouth at the posterior end of the pharynx and cerebral eyes divided into anterior and posterior clusters with only one or two ocelli in the posterior clusters (Kato, 1938). The genital atrium is also similar in that there is, according to the illustration of the species (Kato, 1938, fig. 3) a large penis papilla projecting into the antrum masculinum (Fig. 14), although Kato (1938) stated in the description that there were many muscular villus-like projections, as in *D. japonica*. Furthermore, there are no prostates in the posterior region of the antrum. The most obvious differences between the present specimens and *D. pusilla* are that there appear to be very few prostates in the antrum of *D. pusilla* and that prostates do not occur in the ventral wall of its antrum.

However, Kato's (1938) specimens of *D. pusilla*, were evidently immature as he describes the prostates as rudimentary and Lang's vesicle as being represented merely by a mass of nuclei. As a consequence, the number and distribution of prostates may not have been reliably determined in *D. pusilla*. The current specimens may therefore be *D. pusilla* or may represent a new species. However, since only two specimens are available and since *D. pusilla* has been inadequately described, no new name is proposed for them.

The descriptions presented here indicate that *Discocelis* is represented in Australia by several species rather than the single species, *D. australis*, currently known (Hyman, 1959). While one of the two additional species found can unequivocally be identified as new, limitations in the descriptions of existing species prevent a definitive name being applied to the second species.

The descriptions presented above suggest that in addition to the distribution of marginal eyes, the occurrence of cerebral eyes in a single band or two groups, and the presence of a seminal vesicle, the distribution of prostates within the antrum masculinum as seen in ventral views of cleared specimens provide useful taxonomic characters. In *D. tigrina*, the prostates are arranged in an arc anterior to the gonopore (Lang, 1884), in *D. parvimaculata*, the prostates are arranged in a cluster in the anterior lobe of the antrum and along the postero-lateral margins while in the un-named species the prostates occur throughout the penis papilla and are present along the posterior margin of one pair of lateral diverticula within the male antrum. The type specimens of *D. australis* were examined but they are now very dark and the distribution of prostates cannot be determined. In the remaining species, this character has not been investigated, but current observations suggest that it might provide additional features for the separation of species within the genus *Discocelis*.

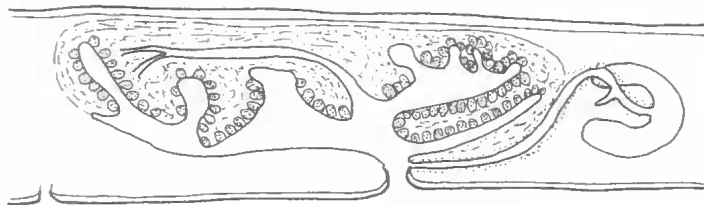


FIG. 16. Schematic representation of genital atrium of *Discocelis japonica*, redrawn from Kato (1944).

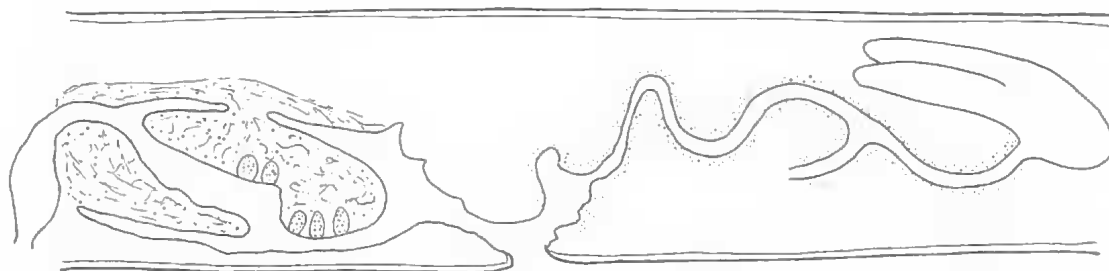


FIG. 17. Schematic representation of genital atrium of *Discocelis australis*, redrawn from Hyman (1959).

ACKNOWLEDGEMENTS

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